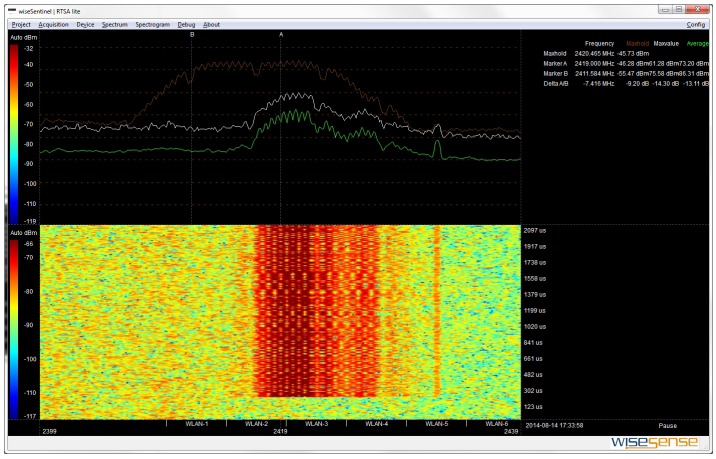

wiseSentinel | RTSA lite

User Manual

Software version 1.0.x.x
August 15, 2014

wiseSense GmbH

www.wisesense.net

Contents

1 Information

1.1 wiseSentinel | RTSA lite

wiseSentinel | RTSA lite can be used to visualize the spectrum in real–time or to do measurement and decoding of captured IQ signals offline.

1.2 About wiseSense GmbH

wiseSense GmbH is a technology oriented company situated in Hanover, the state capital of Lower Saxony. The intelligent, efficient and consistent management of different coexisting wireless services in professional and industrial applications is the key asset which wiseSense GmbH is offering its customers and partners in both the electronic & electrical engineering industry and machine & equipment manufacturing.
The staff members of wiseSense GmbH are experts in wireless with indepth knowledge of technologies, standards and regulation. wiseSense GmbH has a wide record of expertise in the area of wireless network monitoring and analyzis, cognitive coexistence management of heterogeneous wireless environments, softwaredefined cognitive radio systems, and webbased solutions for monitoring and reconfiguration.
Our product portfolio helps you plan, check and manage the **coexistence of wireless systems** in their entirety and according to your needs. The products are especially optimized for users with applications in the wireless process or production automation, but even users in other application areas can benefit.
wiseSense GmbH is offering its technology as Original Equipment Manufacturer (OEM) solutions or Intellectual Property (IP) cores for easy integration in your product portfolio. We are also pleased to provide you with our development services to meet your specific needs.

1.3 Copyright

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1.4 Disclaimer

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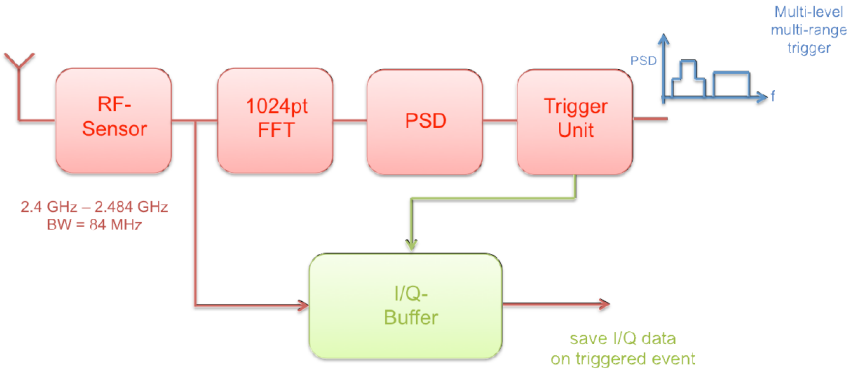
2 General System Concept

The users of professional wireless systems face the challenge of having no adequate tool for radio spectrum monitoring and signal probing in case of interferences, e.g. in the 2.4 GHz ISM band, that can operate over a longer time frame (1 day to 1 week).
The **wiseSentinel | RTSA lite** aims to fill this gap by providing a complete solution for "debugging" the radio spectrum with help of real time radio spectrum monitoring and spectrum rating. The general system concept is based on a Remote Radio Spectrum Hardware Package, e.g. thinkRF WSA5000 RF Digitizer, capable of acquiring continuous blocks of IQdata over a high frequency range (10 MHz to 20 GHz) using very broad instantaneous bandwidth of e.g. max 100 MHz.



As illustrated in Figure 1, the RF digitizer downconverts the received RF signals from a monitored frequency range (e.g. the 2.4 GHz ISM frequency band) to baseband and continuously performs a Discrete Fourier Transform through an efficient Npt FFT operation. Subsequent calculation of the signal Power Spectral Density (PSD) allows to set specific trigger mask in the frequency domain to filter out desired/undesired portions of the signal. The trigger unit then controls the output of an IQ buffer that permanently stores the data of interest for further analyzis.

Main requirements are

- Tunable frequency range and resolution bandwidth
- Large acquisition bandwidth
- High dynamic range acquisition
- Display of multiple traces (e.g. MaxPeak, MinPeak, Average, MaxHold, RMS, Sample)
- Frequency mask triggering (FMT)

- Marker and peak search capabilities
- Statistical reporting of spectrum utilization

Application

- Real-Time Spectrum Analyzis
- Spectrum Rating

3 Installation

3.1 System Requirements

- thinkRF WSA5000 or other supported RF digitizer
- Windows 7 64bit or Windows8.1 64bit
- LAN
- Quad core CPU (or 2+2 with hyperthreading)
- At least 4 GB RAM
- For capturing application it is recommended to have an SSD.

3.2 Install

Run the installer for wiseSentinel | RTSA lite, this will install all needed software and create a program menu shortcut. The C runtime will be installed if it is not already present on the system.

3.3 First run

You will need to configure your capture device the first time you run the application. Use the Project → Open to open a connection to the RF capture device. The wiseSentinel | RTSA lite will store its settings in the registry so you will not need to reconfigure the device every time you start the application.

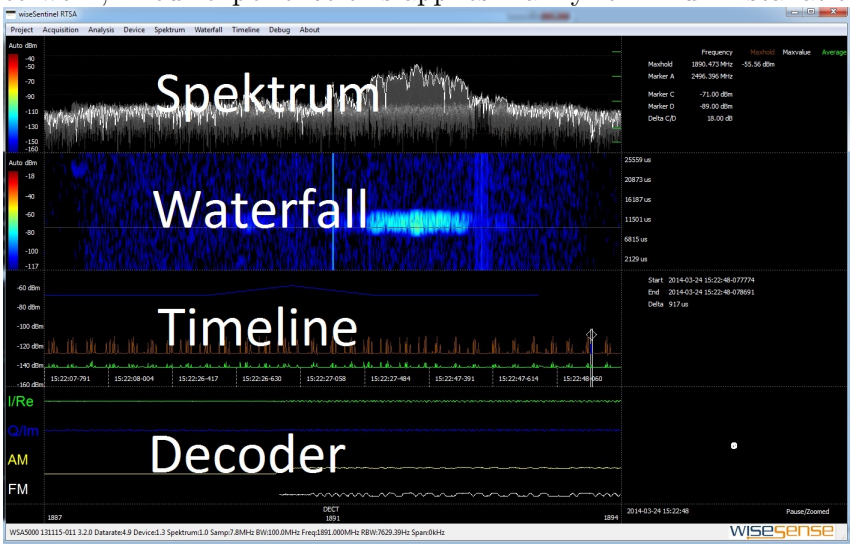
4 wiseSentinel | RTSA lite

4.1 Overview

The wiseSentinel | RTSA lite is a software solution for Real-Time Spectrum Analyzis (RTSA) combined with distinct functionalities for radio spectrum monitoring and radio spectrum rating. The wiseSentinel | RTSA lite functionalities will be improved by modules based on developments done for other products, by cooperation with partners, or by modules developed on customer request.

4.2 Quick Start

In the project menu either open the IQ file to be analyzed or the RF capture device to provide the IQ source.
When opening an thinkRF WSA device wiseSentinel | RTSA lite will scan for devices on the local network and show the devices found. The scan will be done when opening the panel, if no device is shown please close the dialog and reopen it. You can also enter the IP address of the device manually. As broadcast packets are used for device discovery the firewall must be configured to pass these packets onto the application for the auto discovery to work, in our experience this applies mainly for Linux installations.



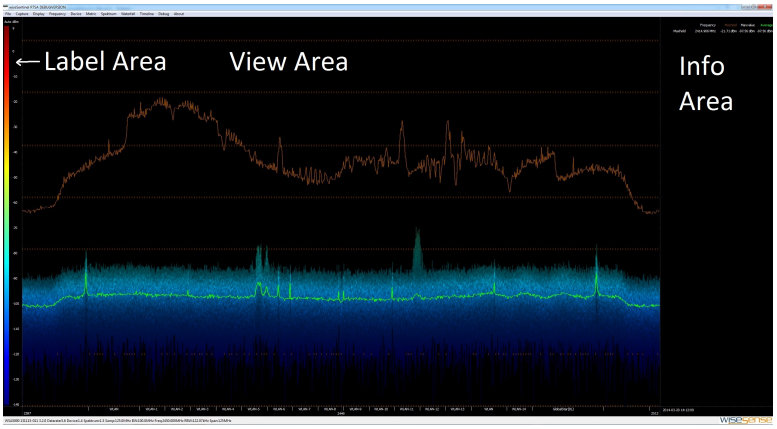
4.3 Panels

Spectrum Provides a front view of the spectrum with or without persistance

Spectrogram Provides a top view of the spectrum, with the power level beeing color coded

4.4 User Interface

The user interface consists of different panels that can be enabled or disabled depending on the current need.



Each panel contains 3 parts, one Label Area to the left, the main signal View Area and an Info Area to the right.
On the right side a control panel can be shown to allow for operation with a touch screen computer, for example for the Android version of wiseSentinel | RTSA lite. The control panel is shown/hidden if you press the config button on the menu in the right side of the menubar (or the wiseSense logo on the bottom of the screen)
On the left side a text output panel for information from the decoder or other program information can be enabled. The text output panel is enabled by selecting this in the menu.
By default both the text panel and the touch panel are disabled. In the case no devices has been preselected the device open panel will be shown when starting the application.

4.5 Control panel

Touching (or pressing left mousebutton in) the info panel a control panel opens that allows you to configure the operation of wiseSentinel | RTSA lite using a touch screen. In the control panel one can also use keyboard input to enter values.

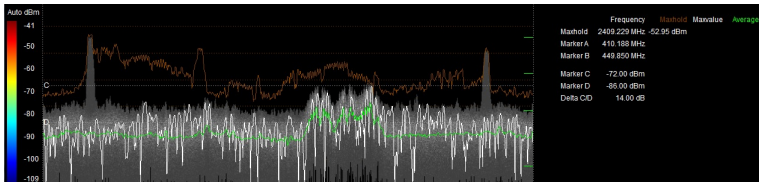
4.6 Text Panel

Provides error and log message in text form or the output of decoder operations.

4.7 Keyboard shortcuts

Keyboard shortcuts can be found in the corresponding menus.

4.8 Spectrum Panel



Mouse left button

If you press the mouse in the spectrum the current frequency is shown and maxhold and average for the current position are displayed.

Mouse right button

The spectrum context menu will be shown.

Markers

Use the menu or the control panel to enable the markers. Once they are enabled the marker lines can be moved around with the mouse. In the info panel you can see the current values for all markers and the difference between the A/B and C/D markers.

Trigger

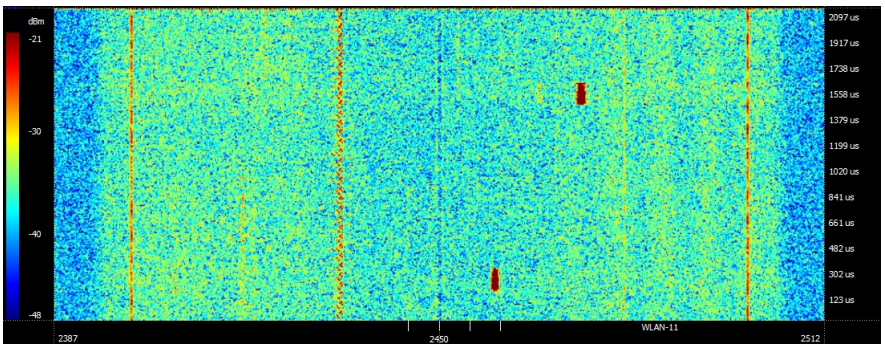
Use the menu or the control panel to enable the markers. Once they are enabled the trigger lines can be moved around with the mouse.

4.9 Spectrogram Panel

Provides a top view of the spectrum with the signal power beeing color coded. The colormap used for the power levels can be switched, and the low level and high level in the mapping can be adjusted in the colorbar on the left side.

Mouse left button

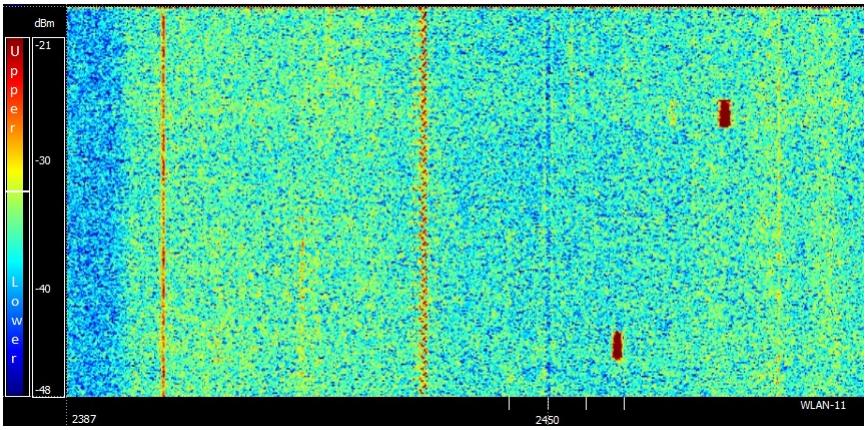
If you press and hold the left mouse button in the spectrogram the delta time and delta frequency will be shown in the Info Area.



Mouse right button

The spectrogram context menu will be shown.

Adjusting levels



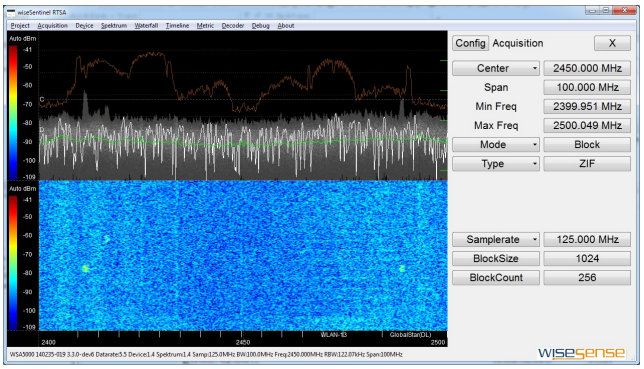
To move the upper level press the left mouse button on the top the colorbar and move the mouse with the button pressed. When finished release the mouse button.

To move the lower level press the left mouse button on the bottom of the colormap lower part and move the mouse with the button pressed.

To move the both lower and upper range press the left mouse button in the area right of the colorbar and move the mouse with the button pressed.

5 Control Panel

To enable the control panel, press in the information area on the right of the view of spectrum / spectrogram. The control panel will open. To close the panel touch the view area.



Project Here you can open and close the devices and enable or disable fullscreen mode.

Acquisition Controls the Digitizer hardware. In this panel you can change the Center Frequency, Sampling rate and other digitizer parameters.

Layout Controls which panels you want to use.

Marker Set and check the values of the markers in the spectrum panel.

Spectrum Controls the spectrum panel.

Spectrogram Controls the spectrogram panel.

6 Menus

Some of the most important menu items can also be accessed via the control panel interface.

6.1 Project

Provides menu to open and close the device, quit the application or open saved IQ data files.

Project → Open File[1]

Opens a file instead of a RF digitizer device. This is to be used for offline analyzis of already stored data.

Project → Open thinkRF

Opens the dialog box that scans for thinkRF devices. If the device is not found during the scan the IP address of the device can be entered manually if needed.

Project → Close Device

Closes the device, this is useful to avoid the autoconnect to use the last used device when you start the application the next time.

Project → Save IQ Samples[2]

Save IQ data to an .iqw file.

Project → Fullscreen

Toggles the operation in full screen mode, this will disable the default window handling.

Project → Quit

Closes the application.

6.2 Acquisition

Acquisition → Toggle

Toggles between capture and pause mode.

[1] This is available once the wiseSentinel | RTSA lite is registered
[2] This is available once the wiseSentinel | RTSA lite is registered

Acquisition → Single

Captures one block and then goes into pause mode.

Acquisition → Triggered

Captures only blocks according to the currently defined trigger.

Acquisition → SingleShot

Captures one block according to the currently defined trigger and goes into pause mode.

Acquisition → ClearCache

Clears the caches for example for maxhold.

6.3 Device

Change the device specific settings.

Device → Frequency

Provides a drop down menu for quick access to selected frequency bands, for example the DECT at 1880 .. 1900 MHz or WLAN bands.

Device → CalibrateIQ

Selects the algorithm to use for IQ imbalance compensation for ZIF based reciever modes.

Device → CaptureMode

Selects between Block capture, Stream capture or Sweeping operation.

Device → CaptureType

Selects type of receiver front end (RFE) mode.
For the WSA5000 the following modes are available

SH Super Heterodyne (SH) receiver with 40 MHz bandwidth (default)

SHN SH mode with 10MHz bandwidth

Device → Samplerate

Selects the device sample rate.

Device → WindowFunction

Selects the Window to be applied on the IQ data before the FFT. For a description on the different window functions consult wikipedia or textbooks.

FlatTop Recommended for CW tones as the power is spread into many frequency bins.

Gauss General Purpose

Hamming Default

Device → RX

Selects device dependand RX options. For the WSA 5000 you can select the capture mode and control the input attenuator here.

6.4 Spectrum

Spectrum → Spectrum

Select the type of Spectrum that should be shown.

Simple Shows Peak signal, with the optional maxhold, average, signal traces

Colormap Colormap density spectrum

Density Monochrome density spectrum

Persistant Time delayed spectrum

Spectrum → Colormap

Selects the colormap used for the Spectrum Display.

Jet

Rainbow

Fire

Greyscale

Spectrum → Show

Selects the secondary functions shown in the spectrum plot i.e. maxhold, average, signal, trigger and markers.

Spectrum → Marker Autoset

Enables all markers and sets them around the cursor.

Spectrum → Marker A / B

Controls frequency markers. Once the markers are displayed you can drag them by selecting the marker and dragging them with the mouse.

Spectrum → Marker C / D

Controls power level markers

Spectrum → Trigger

Controls software or hardware trigger.

Spectrum → Frequency

Adjust the center frequency to the position selected.

6.5 Spectrogram

Spectrogram → Colormap

Selects the colormap used for the Spectrogram Display.

A Additional Information

A.1 Supported Devices

thinkRF WSA4000 (Limited support)

thinkRF WSA5000 V1 (Limited support)

thinkRF WSA5000 V2

A.2 Supported File Formats

File formats [3] supported for input are

wiseSense .iqw Native format.

Tektronix .iqt Only files with IQ data are supported.

Binary IQ data in int16, int32 or float formats without header.

CSV Comma Separated Whitespace

If you have issues reading 3rd party files please provide wiseSense with an example so we can analyze this.

A.3 WSA 5000

Configuration

Use the web page of the WSA 5000 to configure the IP address, time and to update the firmware.

USB console

If the network address of the WSA 5000 is unknown use the procedure in the WSA5000 manual on how to reset the IP address to use DHCP.

Network ports

Communication and datatransfer is done on the ports 37000/37001. The broadcast detect packet is sent to port 18331.

[3] If you need other formats please contact info@wisesense.net for NRE.

B Abbreviations

ACQ Acquisition

AM Amplitude Modulation

AMPL Amplitude

ASK Amplitude Shift Keying

CF Center Frequency

CW Continuous Wave

FFT Fast Fourier Transform

FM Frequency Modulation

FMT Frequency Mask Trigger

FSK Frequency Shift Keying

HDR High Dynamic Range

ISM Industrial, Scientific and Medical

NRE None Recurring Engineering

PSD Power Spectral Density

RFE Receiver Front End

RTSA Real Time Spectrum Analyzis

SH Super Heterodyne

ZIF Zero Intermediate Frequency